

Protecting Reproductive Health and the Environment: Toxics Use Reduction

by Kenneth Geiser

Toxics use reduction is a new chemical hazard management approach that has emerged in several state laws over the past years. While toxics use reduction has been promoted as a means of preventing environmental pollution, little thought has been given to its adoption as a means of managing reproductive hazards. This paper provides illustrations of use reduction approaches to conventionally recognized reproductive and developmental toxicants. These approaches will require the opening of a new dialogue between industrial designers and process managers and those most concerned about reproductive health. Several different strategies are proposed that might be adopted into state programs for promoting reduction in the use of reproductive and developmental toxicants.

Introduction

Toxics use reduction is a new approach to managing industrial toxic chemical exposure that stresses reducing the use of toxic chemicals or the generation of toxic wastes. In contrast to conventional approaches to toxic chemical management that have emphasized engineering controls and personal protective equipment for protecting workers and end-of-pipe pollution controls for safeguarding the environment, toxics use reduction focuses on changes in the chemical inputs, product outputs, and manufacturing processes of industrial production. This new approach has been adopted in several states and written into several pending bills before Congress. To date there has been no formal or systematic effort to link ongoing work in toxics use reduction with reproductive hazards. The objective of this paper is to consider some of the opportunities inherent in such a confluence.

What is Toxics Use Reduction?

Toxics use reduction is a fundamental form of pollution prevention. The concept of pollution prevention first developed as a means of reducing the rising flood of hazardous wastes flowing from industrial production facilities. By the mid-1980s, it had become clear that the conventional approaches to managing industrial wastes by permitting and standard-setting simply were not sufficient (1).

The policy of regulating the release of environmental pollutants had been built on assumptions that small amounts of toxic substances could be safely assimilated into the environment and that effective government action could focus on controlling, rather than eliminating, the release of these pollutants. Throughout the decade, industry invested millions of dollars in pollution control technologies, and Federal and state governments processed hundreds of thousands of pollution release permits. Yet, despite all of this environmental regulation, the volume of toxic and hazardous wastes has continued to increase, and the indicators of environmental quality have shown little dramatic improvement. With industry facing rising waste management costs, communities resisting the siting of waste management facilities, and environmentalists frustrated with poor results, the context was set for rethinking the future of the environmental regulatory system.

The new approach, often called pollution prevention, shifted policy attention from the control of wastes at the end of the discharge pipe to prevention of the generation of wastes at earlier steps in the production processes (2). Toxics use reduction developed as a specific response to the industrial use of toxic chemicals. The idea of toxics use reduction is to change the technologies or materials used in industrial production to reduce the hazards of the waste stream.

The concept of toxics use reduction was first integrated into state law in 1989 when both Massachusetts and Oregon passed similar laws. Once these first state laws had been adopted, it became apparent that programs designed to reduce the use of toxic chemicals in industrial facilities could generate many benefits in addition to the reduction of environmental contaminants. Toxics use reduction offered an opportunity to promote both occupa-

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tional and environmental health in the same undertaking. Chemical risks to workers could be reduced, community health risks from chemical storage and transport could be lessened, and firms could decrease the compliance, liability, waste management, and purchase costs associated with the use of toxic chemicals (3).

Toxics use reduction programs typically require industrial plant staff to inventory and analyze the use of toxic chemicals in their facilities and to identify ways to reduce or eliminate them. The programs often require the development of special "facility plans" that identify a short list of targeted toxic chemicals, set goals for reduction in the use of those chemicals, and then present selected technical options for implementation. The technical options include chemical substitutions, production process changes, product redesign, improvements in operations and maintenance, and in-process recycling and reuse (4).

By 1990, nine states had passed pollution prevention legislation with at least some toxics use reduction components (5). Table 1 identifies the states that passed pollution prevention legislation before 1991, as well as three additional states that passed similar legislation during 1991.

These state programs often designate the Federal Toxics Release Inventory list of Extremely Hazardous Chemicals (Section 313) as the defining list of toxic chemicals (6). Typically the laws include a statewide goal for achieving reductions in hazardous waste generation and state encouragement or mandates to promote facility plans. While these plans are often proprietary, most state programs require some public data reporting in order to measure the progress of firms implementing the programs. Free state technical assistance is frequently offered to assist those firms less technically capable.

The Potentials of Toxics Use Reduction

Toxics use reduction represents a policy approach that is conceptually distinct from and discontinuous with the conventional environmental regulatory policies that have dominated state and Federal government action over the past two decades. Toxics use reduction does not render such regulations obsolete; indeed, this approach flourishes where regulations are tight. However, toxics use reduction does offer an opportunity to bypass some of the problems of conventional regulations, such as the slow chemical-by-chemical momentum, the highly contentious threshold-setting process, the costs and imperfections of risk assessments, the endless problems of enforcing compliance, and the constant threat of litigation and delay.

Table 1. States with toxic use reduction or pollution prevention laws, by year of passage.

1989	1990	1991
Illinois	Georgia	Arizona
Massachusetts	Indiana	New Jersey
Oregon	Maine	Vermont
	Minnesota	
	Tennessee	
	Washington	

Toxics use reduction does not become an attractive approach if it is seen as simply an extension of the regulatory approach. In order to envision the possibilities inherent in toxics use reduction, it is necessary to break with the regulatory paradigm and reconsider the focus of policy and the operating relationships among government, industry, science, labor, and community. Working with firms to encourage innovation in materials and technologies in order to reduce risks offers a new role for state agents. Advising policy makers on priority chemicals for use reduction and exploring new ways of thinking about the "safeness" of potential toxic chemical substitutes offer new roles for scientists and risk assessors. Searching for new "safer materials" and "cleaner technologies" provides innovative missions for engineers and university research centers. Negotiating with management about chemical substitutions and production transitions offers new opportunities for unions to advance health and safety while protecting jobs. Educating the public about the health and environmental risks of consumer products and the processes necessary to manufacture them leads to a more demanding public better able to make wise collective or individual choices about the chemicals in its midst.

This search for a new policy perspective is emerging as we come to understand that no matter how much money, science, or enforcement power we dedicate to the regulatory approach alone, the costs and the problems associated with the use of toxic chemicals will continue to outstrip our capacity to achieve a safe and clean workplace and environment. Although toxics use reduction programs have been moving forward among the states, little has been done to consider the implications for the reduction of reproductive hazards.

Toxics Use Reduction as a Response to Reproductive Hazards

Toxics use reduction focuses on chemical hazards. Physical hazards such as ergonomic stressors or radiation are not covered by toxics use reduction. Toxics use reduction is most appropriately applied to reproductive or developmental hazards (chemicals or biologicals) used in industrial or commercial settings. From a process design perspective, reproductive and developmental toxicants are little different from any other toxic chemical. The techniques that commonly characterize toxics use reduction can as likely be applied to reproductive hazards as to any other targeted industrial substance. Therefore, the policy task is to identify specific reproductive and developmental toxicants and assess the opportunities for substitution or replacement by changes in material inputs, production processes, or product design.

Table 2 lists some commonly recognized reproductive or developmental toxicants (7) along with examples of substitutes or changes in use that reduce exposure. These examples are offered primarily for illustration. There are many other options. A serious toxics use reduction program focused on reproductive hazards would require more detailed analysis tailored to specific industrial uses. However, it is encouraging to note the opportunities to reduce

Table 2. Use reduction illustrations for common reproductive or developmental toxicants.

Lead	Much has already been done in the United States to phase out lead in gasoline and paint. Lead water pipes can be replaced with copper tubing. Lead-based paints have been replaced for most domestic uses. Lead is still extensively used in lead-acid automobile batteries. Researchers working on the solar-powered car claim that there are alternatives to lead in electric storage batteries, but the price would be higher.
Mercury	Mercury is now being replaced as a bactericide in paints. Some European countries are leading the way in phasing out mercury in dry cell batteries.
Organic solvents	The state toxics use reduction programs are finding that chlorinated solvents can be relatively easily replaced in many industrial cleaning and degreasing operations by alkaline or aqueous-based cleaners or by simply eliminating unnecessary cleaning and degreasing steps. A British firm is marketing an alternative dry cleaning process that would substitute a dry vacuum operation for perchloroethylene in clothes cleaning.
Ethylene oxide	Ethylene oxide can be replaced with super-heated water, hydrogen peroxide, or ozone-based processes in hospital sterilization. Ethylene oxide used in anti-freeze formulations can be replaced with alcohols. There are a host of alternative fumigants available for ethylene oxide used in food processing.
Pesticides	DDT was phased out of use in the United States in 1972. Chlordane and heptachlor have both been replaced by other pesticides following the 1976 Federal restrictive use ruling. Although Federal regulations still permit the use of chlordane as a termiteicide, termites can be controlled through careful architectural controls. Kepone has been fully replaced with various integrated pest management practices. Many reports, including those of the National Academy of Science, show that nonchemical alternatives to the use of pesticides in farming need not reduce crop yields or farm income.
Polychlorinated biphenyls	Polychlorinated biphenyls have been phased out of all but contained electrical equipment in the United States.
Glycol ethers	The ethylene glycol ethers (monoethyl and mono-methyl) are used extensively in the semiconductor industry where, in some uses, they can be replaced with propylene-based products. There are many mastics and organic resins that can be used to replace epoxy resins that contain glycol ethers. Glycol ether based de-icing can be accomplished with electric heaters, proper winter cover, or high pressure pellet blasting.

the use of some of the most common reproductive and developmental toxicants.

Integrating Reproductive Hazards into Toxics Use Reduction

If toxics use reduction programs are to address reproductive hazards, there will need to be some shift in

attention among those who know the most about the reproductive effects of toxic chemicals. Epidemiologists, toxicologists, clinicians, health educators, and environmental and occupational health advocates often know little about the processes of industrial production, including where and how specific chemicals are used, why they are used, and what alternatives exist. On the other hand, industrial designers, process engineers, and production managers who specify industrial chemical use have little opportunity for dialogue with those who know about reproductive and developmental toxicants. The first initiative in making toxics use reduction relevant to reproductive hazards will require the bridging of this broad intellectual and disciplinary gap.

Experts who know about reproductive hazards will need to go beyond the conventional exposure control thinking that for years has terminated their policy and patient care responsibilities (8). Pollution prevention and toxics use reduction have extended the traditional focus of environmental professionals into the design and management of industrial processes. Reproductive health advocates need to broaden their focus as well. They need to learn more about manufacturing and open new avenues to teach those who design and run manufacturing processes about reproductive and developmental toxicants. Within this expanded dialogue, toxics use reduction can become a relevant means to promote reproductive health.

Given this expanded dialogue, there are several initiatives that could address reproductive hazards through toxics use reduction, as explained below.

Inclusion of Reproductive and Developmental Toxicants on Toxics Release and Toxics Use Databases. Toxic use reduction programs typically rely on specified lists of substances as a means of defining "toxic chemicals." Many of the state toxics use reduction programs use the Federal Extremely Hazardous Chemicals list found in Section 313 of the Federal Emergency Planning and Community Right to Know Act of 1986 (EPCRA) as the criteria list for defining the chemicals targeted for use reduction. Much of industry's attention has turned to this same list due to the annual Toxics Release Inventory (TRI) mandated under EPCRA. The TRI is a compilation of toxic chemical release reports from over 60,000 industrial facilities throughout the country. The Extremely Hazardous Chemicals list has been developed from two state lists that were drawn from literature based on various risk assessment studies. The list has not been adequately considered in terms of reproductive or developmental toxicants, and many toxicants known to affect reproductive health may be excluded from the list. Each year the list is adjusted as new information is accumulated. The EPCRA law permits members of the public to petition for the addition of chemicals to the list. Reproductive health advocates could call for an analysis of the list in terms of inclusion of all known reproductive and developmental toxicants.

Reproductive and Developmental Toxicants as Priority Targets for Toxics Use Reduction Programs. Several states now have toxics use reduction programs that are advanced enough to be considering priority setting among chemicals on the lists. Consideration of reproduc-

tive hazards at this time could help to focus state programs either on high-priority reproductive and developmental toxicants or on industries in which these hazards are common. The first approach (the chemical approach) could encourage all targeted firms to give primacy to the reduction of reproductive and developmental toxicants. The second approach (the industries approach) could guide states to give highest priority for technical assistance and performance evaluation to those industries in which reproductive hazards are most common. States could be encouraged to include reproductive and developmental toxicants among their highest priorities and require specific reduction data from firms that currently use targeted reproductive and developmental toxicants.

Exclusion of Reproductive Hazards as Substitutes for Targeted Toxics Use Reduction. One common method of toxics use reduction involves the substitution of one chemical for another. Most state programs give little guidance on those substances that are to be considered acceptable substitutes. In order to assist in this area, some advocates have suggested a "safe substitutes" addendum to state laws or the development of a practice protocol called "substitution analysis" that would guide those implementing toxics use reduction programs in moving toward safer substitutes. The exclusion of reproductive hazards as acceptable substitutes for toxic chemicals targeted for use reduction could be included as a basic tenet of any proposed safe substitutes policy. Similarly, the performance of a substitution analysis to assess options for toxics use reduction could include a requirement to evaluate the reproductive and developmental effects of any option proposed.

Reproductive and Developmental Toxicants as Priorities for "Chemical Sunset" Policies. Increasing attention is now turning to the use of chemical bans and phase-out policies as adjuncts to toxics use reduction. The Swedish Chemicals Inspectorate has proposed to the international Organisation for Economic Cooperation and Development (OECD) a "chemical sunsets" policy that would commit OECD countries to phased reduction in production and use of a consensus list of highly toxic chemicals (9). Some of the substances in the initial Swedish proposal are known reproductive hazards (e.g., lead). In selecting chemicals for bans or sunsets, reproductive and developmental effects could be raised as high-ranking criteria.

Alternatively, a call could be initiated for a national or international phase-out of the use (or production) of specific well-recognized reproductive and developmental toxicants. Although the consequences of such a phase-out would require much more investigation, the call itself might serve to raise the current level of public and technical discussion.

Toxics Use Reduction as a Response to Plant Closure Threats at Sites Where Reproductive Hazards Have Become an Organizing Issue. Firms confronted with worker or community demands to remove reproductive hazards may respond with threats to close operations. Such threats, or the anticipation of such threats, can dampen the strength of local level advocacy. Demands for

toxics use reduction programs offer a positive and less threatening option that may allow workers or citizens to press for reproductive hazard elimination in a manner that is acceptable to facility managers. The programs in place around the country can be used as models for constructive advocacy. The identification of similar facilities that have successfully reduced toxic chemical use through such programs may provide an inducement to reluctant managers.

Compensation Programs That Protect Workers Displaced by Reproductive Hazard Elimination Programs.

In some cases, the reduction or elimination of specific reproductive hazards from industrial users may result in extreme dislocations for workers who have mined, manufactured, or synthesized those substances. Phasing out lead, for instance, would result in the closing of the last two commercial lead mines in the United States, as well as the closing of several lead smelters. The burden of these dislocations should not be thrust upon workers and communities without economic assistance. A special government fund, perhaps generated by a special fee on chemical producers, should be established to provide the resources necessary for making these transitions in a manner that is fair and equitable (10).

Who Needs to Do What?

Conventional thinking about reproductive hazards is still dominated by a regulatory mind set. Most of the policy work is consumed in determining safe levels of exposure to recognized reproductive hazards or the removal of vulnerable populations from such exposures (11). For the near term, standard setting remains an important policy instrument. However, a more fundamental preventive approach requires that increasing attention be turned to the reduction and elimination of use of known reproductive and developmental toxicants. This goal will require a shift in focus and action for those most concerned about reproductive hazards.

Environmental organizations that currently advocate toxics use reduction policies need to become more familiar with reproductive and developmental toxicants and their health risks. Human reproductive health, particularly that of workers, needs to be considered as important an end point as human cancer reduction, atmosphere protection, or ecological integrity.

The idea of reduction in use of reproductive and developmental toxicants needs to be more forcefully embraced by national reproductive health advocacy organizations. Targeted chemical elimination in industry and commerce needs to become a more central tenet of male and female reproductive health promotion.

Business organizations must become better educated about the costs of using reproductive or developmental toxicants in industrial production. Firms that have successfully reduced or eliminated known reproductive hazards need to be publicized and studied for the lessons that they present. Trade unions must become more assertive in negotiating for the removal of highly toxic chemicals, including reproductive hazards, from production operations where they seek to protect jobs and upgrade the

conditions of the work environment. Governments at all levels must become more aggressive in targeting certain highly toxic chemicals such as reproductive and developmental toxicants and working with industry to affect the reduction and elimination of these substances.

Toxics use reduction is an action-oriented approach to the safe management of industrial chemicals. Where it has been implemented, toxics use reduction has encouraged creative new techniques for the manufacture of products in ways that are less hazardous to workers and consumers and more compatible with the environment. Our approach to reproductive hazards should be similarly focused on designing industrial production processes that minimize the threat to reproductive health. Although the future requires more research and better controls on reproductive and developmental toxicants, we need to begin now to promote policies that encourage the design of cleaner and safer production systems that function without reproductive concerns.

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